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An Equation for the "Sum of Squares equal a Square" by R. J. ADCOCK, Larchland, Illinois.

The following identical equation for the sum of squares=a square, I have not seen published. If $u=x+y+z+v+w$, $u^2=x^2+y^2+z^2+v^2+w^2+2xy+2xz+2xv+2xw+2yz+2yw+2yw+2zw+2vw+2vw$; and if the sum of products two in a set=0, $u^2=x^2+y^2+z^2+v^2+w^2$, $w=-\frac{xy+xz+xv+yz+yv+zw}{x+y+z+v}$,

$$u^2=x^2+y^2+z^2+v^2+\left(\frac{xy+xz+xv+yz+yv+zw}{x+y+z+v}\right)^2=$$

$$\left[x+y+z+v-\left(\frac{xy+xz+xv+yz+yv+zw}{x+y+z+v}\right)\right]^2.$$

Clearing of fractions and reducing, $[x(x+y+z+v)]^2+y^2(x+y+z+v)^2+z^2(x+y+z+v)^2+v^2(x+y+z+v)^2+(xy+xz+xv+yz+yv+zw)^2=(x^2+y^2+z^2+v^2+xy+xz+xv+yz+yv+zw)^2$. True for three or any greater number of letters.

COMMENT.—In the solution of problem 21, page 163, Vol. II, May No., Dr. Martin uses an ingenuous method for finding a general formula "to find nine integral square numbers whose sum is a square number."

The same formula, expressed for finding n integral square numbers whose sum is a square number, may be produced, more directly, from $(2pq)^2+(p^2-q^2)^2=(p^2+q^2)^2$. Put $p^2=m_1^2+m_2^2+m_3^2+\dots+m_{n-1}^2$ and $q^2=m_n^2$, in which $m_1, m_2, m_3, \dots, m_n$ represent any n integers.

We readily obtain $(2m_1m_n)^2+(2m_2m_n)^2+(2m_3m_n)^2+\dots+(2m_{n-1}m_n)^2+(m_1^2+m_2^2+m_3^2+\dots+m_{n-1}^2-m_n^2)^2=(m_1^2+m_2^2+m_3^2+\dots+m_n^2)^2$.

Illustration. Let $n=9$, and put $m_1=1, m_2=2, m_3=3, m_4=4, m_5=5, m_6=6, m_7=7, m_8=8$, and $m_9=9$. Substituting these values in the formula and dividing by 12, we obtain $1^2+2^2+3^2+4^2+5^2+6^2+7^2+8^2+14^2=20^2$.

PROBLEMS.

37. Proposed by A. H. BELL, Hillsboro, Illinois.

Find the first four, integral values of n in $\frac{n(5n-3)}{2}=\square$.

This is the general form of septagonal numbers, 1, 7, 18, 34, 55, etc.

38. Proposed by H. C. WILKES, Skull Run West Virginia.

Let n be any number and let $n^3+1=x$. Then $x^3+(2x-3)^3+(nx-3n)^3=n^3x^3$. How can this be demonstrated; it will always be found true on trial.

39. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pennsylvania.

The m th root of the n th power of an integral number is a perfect p th power. What is the number?